

### **REMARKS**

Reconsideration in view of the foregoing amendments and following remarks is respectfully requested.

In the Office action dated August 9, 2002, claims 1 and 2 were rejected under 35 U.S.C. 102(b) as being anticipated by each of Aldridge et al. (U.S. 4,217,024) and Khadem et al. (U.S. 5,886,878). Claims 1 and 2 have been canceled and replaced by new claims 3-6 which define the invention so as to clearly distinguish from each of Aldridge et al. and Khadem et al.

Specifically, and looking first to Aldridge et al., claims 3-6 distinguish therefrom in setting forth that the substrate (claims 3 and 4) or printed circuit board (claims 5 and 6) is the member on which the plurality of spacer pads are formed. In Aldridge et al. the parts called "standoffs", which serve as spacers, are formed on the DIP (dual-in-line-package) socket housing 7, not on the printed circuit board 19. Hence, for this reason alone not only does Aldridge et al. not anticipate any of the new claims 3-6, but Aldridge et al. did not even anticipate the original claims 1 and 2. Further, in Aldridge et al. the through-holes 17 do not each have a plurality of spacer pads oriented around the perimeter thereof, as called for in the new independent claims 3 and 5. Therefore, neither does Aldridge et al. have the details additionally called for in new claims 4 and 6.

Turning now to the Khadem et al. reference, it is admitted that this reference anticipated the original claims 1 and 2. However, the new claims 3-6 distinguish over Khadem et al. in a very significant respect. In particular, in Khadem et al. the spacer pads 160 are located on the printed circuit board 100 approximately mid-way between the through-holes for the leads 180; whereas, in the instant invention as defined in the new claims 3-6, each through-hole has a plurality of spacer pads oriented around its perimeter. In Khadem et al., placement of

the spacer pads 160 as shown does not operate to stabilize the component 170 properly during the wave soldering process because the component 170 can tilt downwardly toward the printed circuit board at either end and as a result still be subject to the drawback discussed by Khadem et al. in the sentence bridging columns 1 and 2 thereof. However, by placing a plurality of spacer pads around the perimeter of each through-hole, as specified in the new claims 3-6, the component is fully stabilized and the above-mentioned drawback discussed by Khadem et al. is remedied.

For the reasons set forth, it is clear that the new claims 3-6 distinguish over the Aldridge et al. and Khadem et al. references applied in the Office action of August 9, 2002. Also, the new claims 3-6 define over all of the references mentioned in paragraph 3 of the August 9, 2002, Office action whether considered individually or in combination. Accordingly, the new claims 3-6 are directed to patentable subject matter and reconsideration and allowance thereof is respectfully requested.


If there are any further issues yet to be resolved to advance the prosecution of this patent application to issue, the Examiner is requested to telephone the undersigned counsel.

Reconsideration and allowance is respectfully requested.

Respectfully submitted,

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By

  
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**CIRCUIT BOARD HAVING IMPROVED  
SOLDERING CHARACTERISTICS**

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**CROSS REFERENCES TO RELATED APPLICATIONS**

[0001] None.

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**BACKGROUND OF THE INVENTION**

**FIELD OF THE INVENTION**

[0002] The present invention is for a circuit board,  
and more particularly, is for a circuit board having improved  
soldering characteristics with respect to components which can  
10 be secured to a circuit board such as by soldering.

**DESCRIPTION OF THE PRIOR ART**

[0003] Prior art circuit boards often utilize wave  
soldering techniques to flow liquidized solder at a raised  
temperature along one surface or more of a circuit board to  
15 effect multiple solder joints between the soldering pads of  
the circuit board and the leads of one or more electrical or  
electronic components such as, but not limited to, a light  
emitting diode. Maintaining the quality of a suitable solder  
joint can be problematic in that a cold solder joint may be  
20 produced when solder cannot flow fully into the region of  
intended solder flow. Such a problem can be caused due to  
limited or non-existent gas flow and breathing within or above  
the region of intended solder flow, such as caused by the  
region of intended solder flow being a closed space having a  
25 pneumatic-like seal whereby solder flow cannot reach the  
region of intended solder flow, or if the solder does reach  
the region of intended solder flow, the heat is dissipated due  
to slow movement of the solder before sufficient heating of  
the solder joint takes place. Additionally, air or other

## SUMMARY OF THE INVENTION

[0004] The general purpose of the present invention is to provide a circuit board having improved soldering characteristics.

5 [0005] According to one embodiment of the present invention, there is provided a circuit board having improved soldering characteristics having raised structure consisting of spacer pads arranged to provide for vertical distancing of electrical or electronic components from the component side  
10 planar surface of the circuit board to create a vented space between the planar surface of the circuit board and the body of an electronic component as well as a slightly increased size space at the solder station(s). The spacer pads, which can be of different forms, are located in close proximity  
15 about the regions where the components are to be located on the component side of the circuit board. One form of a spacer pad can be a stand alone spacer pad and another form can be a spacer pad juxtaposing a solder station, referred to as a terminal spacer pad because of its near location to the solder  
20 station or "terminal." Regardless of the form of spacer pad, whether a stand alone spacer pad or a terminal spacer pad, the upper surface of each spacer pad projects a like distance above the planar surface of the circuit board to provide for component spacing from the planar surface of the circuit  
25 board. More importantly, such spacer pads raise the lower surface of the component above the levels of the solder stations so that venting is allowed and provided extending upwardly through the circuit board at the upper region of the circuit board at the solder stations. Such venting allows for  
30 escaping of gases through the upper regions of the solder stations to negate a vapor lock, thus allowing unimpeded flow

of molten solder therein in a timely fashion to effect a proper solder joint.